RESEARCH PAPER:

Fungal biosorption of cadmium and zinc from industrial effluent

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SUMMARY

As a part of the systematic study of bioremediation of heavy metals from soil and aquatic environments, biosorption of Cd and Zn on living, dead and immobilized biomass of native isolate from local industrial effluent and artificial metal solutions were studied. Maximum biosorption (99%) in the order of Zn> Cd was achieved at pH 6.0 within 30 minutes using 1.0g of biosorbent. Immobilization increased stability of living biosorbent. Batch process was found superior over continuous column biosorption. Further, proteins profiles reflected metal toxicity mediated essential metabolic adjustments for high stable efficiency of isolate.

Key words : Fungal Biosorption, Cd, Zn, Industrial effluent

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Heavy metal contamination in soil and water is currently one of the most troublesome environmental problems faced by mankind. A sudden boost in industrial activities has contributed quantitatively to the alarming increase in the discharge of metal pollutants into environmental sink, especially the aqueous environment. Dispersion of the metal ions in the water bodies leads to their biomagnifications through the food chain and results in increased toxicity. This fact renders the removal of heavy metals from aqueous solutions indispensable. Metals discharged into water bodies are not biodegraded but undergoes chemical or microbial transformations, creating large impact on the environment and public health (Nowrot *et al.*, 2006; Green-Ruiz *et al.*, 2008). Metals and their free radicals are highly reactive in terms of attacking other cellular structures. The ability of metals to disrupt the function of essential biological molecules, such as protein, enzyme and DNA is the major cause of their toxicity (Volesky, 1992; Frausto da Silva and Williams, 1993).

Bioremediation technology is economically feasible, easy to apply to contaminated sites and causes little secondary pollution as compared to other known techniques. Since microorganisms have a genetic character for survival strategies in heavy metal polluted habitats, their specific microbial detoxifying mechanisms such as bioaugmentation, biomineralisation and biosorption can be applied eighter "*ex situ*" or "*in situ*" to the design of economical bioremediation processes. Microbial biomass can passively bind large amounts of metal (s), a phenomenon commonly referred to as biosorption(Malik, 2004; Umrania, 2006; Ahluwalia and Goyal, 2007).

Algae, bacteria, fungi and yeasts have proved to be potential metal biosorbents. Among micro organisms, fungal biomass offers the advantage of having a high percentage of cell wall material which shows excellent metal-binding properties. Fungi are known to have good metal uptake systems (Gadd, 1986) with metabolism-independent bio-sorption being the most efficient. The specific mechanisms of uptake differ quantitatively and qualitatively according to the species, the origin of the biomass and its processing .The hyphal wall was found to be a primary site of metal ion accumulation (Tobin *et al.*, 1984). In addition, living biomass may subject to toxic effect of heavy metals at elevated concentration. To overcome the disadvantages; non-viable or dead biomass is preferred (Butter *et al.*, 1998). Potential of filamentous fungi in bioremediation of heavy metal containing industrial effluents and wastewaters has been increasingly reported from different parts of the world. However, filamentous fungi of heavy metals polluted habitat in India are not largely screened and exploited for their bioremediation potential. Therefore, in this study, a native industrial effluent contaminated soil isolate of fungus was used for the removal of Cd and Zn from a local industrial effluent.